ANNALS of the
Association of American Geographers

Volume XXXVIII JUNE, 1948 Number 2

ON THE MORES OF METHODOLOGICAL DISCUSSION IN AMERICAN GEOGRAPHY*

RICHARD HARTSHORNE
University of Wisconsin

AMERICAN geographers reveal a paradoxical attitude toward questions concerning the nature of their field of work, its purposes and general methods of procedure. If one were to judge from published studies, one would conclude that they are not greatly concerned to examine these questions. But just the opposite conclusion would be drawn if one judged from the amount of controversial discussion in which they engage over these questions.

Surprisingly little controversy develops over the content of substantive works. Our field is so vast in proportion to the number of workers in it that our paths cross all too seldom. More often we are working along more or less parallel lines in different areas. Methodology therefore constitutes the principal common factor in our work, the one aspect on which all feel more or less competent to speak. At the same time, the history of development of American geography has been such that there is less agreement among us over the nature of our field than there is concerning substantive questions within the field.

That we regard methodological questions as important is attested by the extent to which we discuss them. Yet our discussions of methodology tend easily to argument and fruitless controversy. Recognizing this, we criticise each other for the way in which we discuss and argue these questions about geography. Such criticisms imply the existence of rules of proper attitudes and conduct, unwritten rules more or less generally accepted by American geographers.

Recent experience, both as critic and as target for criticism, caused me to ponder on what are the mores of American geographers as a social group in discussions of this nature. Concrete evidence of our reactions was available to some extent in published literature, in larger part in my memory of discussions at annual meetings of this Association, and particularly in many specific comments that have been made

* Presented at the Annual Meeting, December, 1947.

to me orally and in correspondence concerning my own discussions of the nature of geography.[1]

The purpose of this paper is to induce from this evidence the specific attitudes and rules that represent current *mores* of methodological discussion among American geographers, and to analyze and determine the validity of each of these.

I. WHY TALK ABOUT GEOGRAPHY?

The first conclusion of fact is that there is considerable doubt among American geographers whether there is any value in methodological discussions. Superficial examination of the evidence might lead one to conclude that all geographers could be divided into two groups; those who argue about what geography is and those who argue that such talk is waste of time. But we find that individuals who have been prominent in discussions about geography have at other times indicated that such discussions are not important. Many stand on the side-lines and accept in part the viewpoint of both groups. Others feel that the discussions are of value only in earlier years of training, but are fruitless after a worker has established his objectives and methods.

The existence of these amphibians suggests that the issue involved is not realistic. Surely anyone who likes to be called a geographer—and don't we all?—has some concern over what the word means. Some may say that they prefer to demonstrate their concept of geography by their substantive works and wish that others would be content to do likewise. But I found that you need only to scratch a geographer to discover that he has a fairly definitely formulated concept of what geography is, what it should do, and how it should do it, and that he does not regard this concept as uniquely valuable to himself alone. If he writes a book, he will state his concept in the introduction if not in the text and he constantly presents it to the students who are under his influence.

In short, none of us would really accept the popular idea that it doesn't matter where you are going as long as you are on the way. We all recognize, in fact, that each geographer must somehow find answers to the questions: "What is geography?", "What is its purpose?", and "How should it be studied?"

The real issue is not over the importance of the questions, but whether any

[1] No small part of the evidence on which this paper relies is drawn from criticism directed at the author's study of *The Nature of Geography* both in published reviews and still more in personal letters, many of which have been frank and penetrating though always cordial. In using evidence of this character it does not seem appropriate to specify the sources, but to limit myself to a general expression of appreciation to all colleagues who have thus contributed to the thinking in this paper. Particular appreciation however should be expressed of Lester E. Klimm's "Commentary" on the Second Printing of the work (*Geographical Review*, July 1947, pp. 486–490). In addition to the information he took the trouble to gather on the use to which the work has been put, he has summarized with considerable effectiveness, I believe, the reactions of American geographers not only to that work, but to methodological discussion in general.

progress can be expected from discussion of them. Some hold that such discussion produces only argument, yielding heat but no light. Can we accept this form of intellectual defeatism?—that men of similar training, engaged in the same field, but holding different concepts of that field and how one should work in it, cannot by discussion arrive at any greater degree of agreement, or at least of mutual understanding of why they disagree?

This question is answered I think by the reaction of geographers to serious effective studies in methodology; many who have published such studies will confirm—often with regret—that those have aroused more attention and response than any or all of their substantive works. Such popularity may not be deserved, but it is not without reason. I suggest that the reason is that American Geographers, by and large, no matter what they say about it, are in fact seriously concerned with methodological questions.

If this judgment of fact is correct, we need only to recognize it. We can then agree to treat methodological questions as among the important matters that we have to study and discuss in common.

II. TO TALK OR TO STUDY?

How should methodological questions be studied and discussed? It is a very common attitude among American geographers that the fundamental questions of what and how you do in geography are suitable for oral discussions whenever geographers gather together, but are not appropriate for serious scholarly writings and work; that such discussions are not productive. It is only a minor modification of this to add that on occasion, notably in a presidential address, it is appropriate for a geographer to present to his colleagues, as a "confession of faith," the personal views he happens at the moment to hold on these questions. Such addresses, it is held, are to be considered as little more than well-formulated statements for oral presentation and should not be subjected to critical examination as though they were scholarly writings.

If the validity of methods may be judged by the results obtained, the weight of evidence completely reverses this rule. All of us have witnessed lengthy oral arguments on these questions and observed little or no influence on the thought of either the participants or their hearers. Yet no one familiar with the development of geographic thought during the past twenty years can question that scholarly studies, presenting not merely the thought of the authors but that of large numbers of their colleagues and predecessors, had a pronounced and developmental effect on the thinking of a very large number of research geographers. In affecting their thinking it has influenced their substantive work; it has been productive in its effects.

We might therefore agree with those who say that discussion of such questions is fruitless in so far as such discussion consists of oral argument. But to say that scholarly discussion, based on critical examination of previous writings and cool logical analysis, was without effect, would be to deny the facts of experience.

These considerations lead to the following conclusions:

1. The most rapid progress toward a common understanding of sound methodology in geography is to be expected by the application of responsible scholarship to the problem concerned.

2. Oral discussion has value only in a secondary phase, in which it can utilize the results of such scholarship rather than depend merely on what the individuals assembled happen to think.

As a corollary we may add that such oral discussion is likely to be of most value if held in seminar form and least likely to be productive at formal meetings of geographers' associations.[2]

III. IS SERIOUS CRITICISM DESIRABLE?

The use of the words "responsible" and "scholarship" in the previous conclusion brings us to a third attitude, namely, that it is not *fair practice* to take "too seriously" what a geographer happens to write and publish on methodological questions. One should realize that the authors of methodological studies, in writing them, did not take them as seriously as they do their "real scientific work." Why not? Have they any reason to suppose that their substantive work will have a greater influence in geography than their methodological writings? Whatever the answer they might give to that question, they must have hoped that their methodological writings would have some significant influence on readers; why else offer them for publication? Geographers presumably do not write and publish merely for self-expression; like all other serious writers, their purpose is to influence people.

It is true that at times one writes with the intention of influencing merely the thought of the moment, whereas in other studies one hopes to produce something of lasting influence. But which will prove to be the case cannot be determined by the author. The novelist Blackmore is said to have been indignant that the public would not recognize what he regarded as his more important works, but insisted on acclaiming and reading only one of the lesser ones—*Lorna Doone*. After more than a century, Julius Fröbel is known in geography almost exclusively for two rather ill-informed, methodological essays written in his youth. A much more thorough essay in the same field, as well as substantive works that he regarded as much more important, were apparently never of much influence and indeed have been mentioned in our time only because current interest had been aroused again in his early im-

[2] It was largely because of the conclusions stated above that *The Nature of Geography* came to be written. There was need, it seemed, for a thorough, even exhaustive, examination of what our fellow-workers in previous periods and other countries had learned from serious study of the problems which we were debating orally. Such a study might, it was hoped, make unnecessary much of the seemingly endless argumentation into which our method of discussion had led us and, for questions still unresolved, would prove a background of learning that might make future discussions productive. In view of the use to which that study is being put in graduate training, according to Klimm's report, a number of references to it are included in this paper, not for personal defense, but in order to explain misunderstandings and to prevent misuse.

mature articles.[3] The critic of current thought in geography may agree with Fröbel's judgment of the relative merit of his different works and still concern himself only with those two articles as the only work of Fröbel that is significant in current thought.

Whatever a writer may think of the relative importance of his different works, it is difficult to take with any seriousness the claim that one has taken any of his serious writings too seriously. I know of no geographer who has objected because students who accepted what he wrote had taken his precepts too seriously. As long as a geographer's methodological writings are taken as gospel, no objection from the author is heard; seriousness becomes excessive only when adversely critical.

If we assume that the purpose of methodological discussion is to seek truth, to find the most reliable method of approach to our subject, we should suppose that critical discussion of a man's methodological writing was the only kind of discussion that could be of value to him for his own thinking. The questions of methodology are involved and logically complicated, seldom permitting of a clear and certain answer. They deal with ideas that cannot be expressed in relatively precise forms of statistics, map distribution, or clearly defined descriptive terms, but only in words commonly ill-defined and slippery in meaning. Consequently there is always great chance that the writer deceives himself and his readers. Fortunately, on the other hand, most of the problems of geographic methodology have been studied in published writings by a large number of geographers during the past two centuries. These provide a multitude of checks on the thinking of any who attempt to consider the same problems today.

It is therefore amazing to learn that an author of a methodological study is not interested in the comparison of his views with those of others who have studied the same problem, or that he is not interested in critical examination of the logical reasoning of his own presentation. Is it really of no value to a geographer holding a particular concept to have his ideas subjected to the test of comparison with those of others, to the test of logical analysis by others? Is any of us so certain that he is on the right track that an examination of that track which other geographers have made before or make now is of no significance to him?

One may seek to dismiss these questions by simply saying, "I do not like dialectics," but to do so is simply to say he does not like logical argumentation, that is, that he is not interested in having his writings subjected to the only check by which we can make sure of the soundness of conclusions reached by the process of reasoning.

In short, anyone who says that he is not interested in a critical analysis of the logic of his writing is saying that it is of no concern to him whether his conclusions are sound, dubious, or completely erroneous. If that be true of any writer—if it can be true—it cannot be true of serious students who will read his writings.

[3] *The Nature of Geography*, pp. 72–75, 102–106.

In place of the attitude that methodological writings should not be taken too seriously—that methodology is a field in which any geographer may dabble freely when the spirit moves him—we are led to the following conclusions:

1. The measure by which we judge the seriousness with which any writings are to be considered is not the degree of importance given them by the author, but the degree of importance they have for readers.

2. Methodological studies require standards of scholarship no less exacting than those expected in substantive work.

3. It is both appropriate and desirable that any methodological writing worthy of publication should be subjected to critical evaluation in terms of its basic assumptions, the reliability of its evidence, the soundness of its logical reasoning, and extensive comparison with the findings of other students of the same problem.[4]

IV. MAY ONE ASK "IS IT GEOGRAPHY?"?

The best known of all our unwritten rules is at the same time the least understood. This is: that while it may be desirable and important to seek an answer to the question, "What is geography?", it is undesirable if not reprehensible to apply the answer arrived at to any specific study by a geographer—to raise the question "Is it geography?" Perhaps the rule is best known because of the frequency with which it is violated and the vigorous reactions of disapproval which such instances provoke. One such expression deserves to be lifted from its relative obscurity: "I am at a loss to understand this pernicious anemia that has seized upon some geographers, expressed in a weary shaking of the head at sight of a fellow student happily productive and in the monotonous, sepulchral query: 'But is it geography?' . . . whence do they derive the authority to correct or even read out of the party those who concern themselves also with" certain topics that the geographers in question have decided are not included in the field?[5] I presume all of us would join in the chorus of disapproval. And yet which one among us has not, in listening to the papers presented at our annual meetings or reading papers published in geographical journals, asked himself, "Is this also to be included in the field that I should recognize as geography?" Evidently there is confusion in our thinking concerning the proper purpose of formulating a definition of geography and the usage to which it should be put.

We may make a major step toward dissolving this confusion, and, I would hope, be able to eliminate much discussion that is not pertinent and often offensive, if we would agree upon the following three principles.

[4] For an excellent example of critical analysis of previous methodological writings, see Edward A. Ackerman, "Geographic Training, Wartime Research, and Immediate Professional Objectives," *Annals of the Association of American Geographers*, XXXV, No. 4 (December 1945), 121–143.

[5] Carl Sauer: Correspondence with the Editor, *Geographical Review*, XXII (October 1932), 528.

A. Is the Question Relevant?

A judgment classifying the relation of a particular research study to the field of geography does not constitute a significant criticism of that study: it cannot in any way reflect on the value of that study; it is merely a statement of classification devoid of value judgment. I know of no basis for assuming that a geological study or an historical study is of less value than a geographic one; a study that combined the techniques of two or more disciplines to such an extent as to be difficult to classify might well produce a superior contribution.

It follows therefore that, when a substantive work is presented for consideration, our proper concern is with the work itself, its thoroughness, soundness, and significance for learning. Any question concerning its relation to the field of geography diverts the consideration away from the work itself into a discussion of another topic, namely methodology. Like any other diversion it is out of order. The question of classification might well be left to the cataloguers.

B. Who Shall Set the Limits?

The second principle is that there is not and cannot be any basis on which geographers as a group may decide that any particular topic is not to be included in the field of geography.

In view of the wide expanse of a field that literally covers the earth and in that coverage must include, in any man's definition, such a great variety of different categories of phenomena, it is entirely natural that geographers should wish somehow to limit the scope of study in which they are expected to be competent. Each geographer must decide for himself in how wide a field he will endeavor to attain and maintain competence. If he decides that a particular research work is so remote from his own field of study that he finds no desire or need to incorporate its findings into his own scope of knowledge, that judgment is of concern only to himself; ordinary courtesy should prevent him from giving public expression to his lack of interest in the work.

It is however a common and proper desire of most geographers to include within their field of general interest and competence all of the field that they regard as geography. Any methodological study of geography is of value to them therefore if it provides them with a basis for measuring the scope of that field and for orienting in relation to it substantive studies which they hear or read. If some of us present definite statements of what geography is or ought to be, any who are impressed by what we write will tend to apply the conclusions to specific substantive papers. Since the purpose of any attempt to find an answer to the question "What is geography?" is to provide a systematic orientation, such use of the conclusions is appropriate and to be expected. In concrete terms, when any geographer who has developed or acquired some definite concept of the field of geography reads or hears

a substantive paper, he may find it useful to ask and answer to himself the question: "Where does this study fit into the field of geography as I understand it?"

If however he gives public expression to a conclusion that a particular work does not belong in the field of geography, he is merely challenging one personal opinion—that of the author who presumably thought his work was included in geography—with another personal opinion of no greater validity. For any judgment classifying a particular work in relation to the field of geography is valid only in terms of the particular concept of the field on which it is based and there is no license for assuming that any one concept carries any more authority than any other conceivable concept of geography.

Likewise we may not seek to establish any authority. Though the proper purpose of methodological study of the question "What is geography?" is to seek the maximum degree of mutual understanding in the field, even if we should attain to virtual unanimity, we do not desire and may not require conformance. In the field of learning we can recognize no orthodoxy and therefore no heterodoxies. In studying the question "What is geography?" therefore, we may not seek and cannot produce a formula for determining whether specific works by geographers are admissible or inadmissible in the field of geography. The word "but" in the question "But is it geography?" is always out of order.

C. Purposes for Which the Question Is Relevant

In a methodological discussion it may be appropriate or even necessary to illustrate or to test theoretical conclusions by applying them to specific substantive works and in doing so to discuss the relation of those substantive works to the field of geography.

To take a simple example, one may need to clarify a difficult theoretical discussion of the logical distinction between geography and some other field by applying the theoretical concept to specific borderline studies. Any conclusion placing those studies on one side or the other of a theoretical borderline has, as we have seen, no significance for those studies; significant only is the fundamental theoretical distinction thus illustrated.[6]

A more important case occurs when a writer presents a statement of the scope of geography which clearly would not include certain types of work hitherto cultivated by geographers. To justify this, to defend his concept against the obvious charge of being inadequate, the writer must show that works of the type omitted are more properly included in some discipline other than geography. He cannot do that in terms of theory; for that would be merely to argue in a logical circle. He must show by judgments of concrete cases that studies of the type in question lack characteristics—of purpose, organization and techniques—generally recognized as

[6] Examples may be found in *The Nature of Geography*, pp. 408, 419. In both cases any possibility of protest from authors was eliminated by selecting examples from the writer's own publications, though at the risk of appearing to regard them as unduly important.

essential to geographic work and are in these respects more akin to work in another discipline.[7]

A similar problem arises when a methodological writer attempts to test the validity of precepts for geographic work by examining the fruits of those precepts as presented in substantive works produced under their influence. The lack of such concrete tests seems to me to be a major weakness in much of our methodological discussion. In considering a particular concept of the field of geography, or specific precepts for work in geography, it is directly pertinent and significant to determine in fact whether the works produced under the influence of those theoretical directions are in their organization, purposes, and techniques of a character generally recognized as geographic or whether they are not more akin to other fields.[8]

In all of these cases, it should be noted, the judgments made of substantive works are appropriate only as contributing to the methodological discussion (and are in order only if the topic of discussion is methodological). In presenting such judgments, the writer cannot prevent the reader from regarding them as criticisms of the substantive studies used as examples—even though he insists that no criticism is involved. Neither can he prevent the reader from treating them as judgments determining the admissibility or inadmissibility of those studies in geography. But in either case it is the reader who is responsible for the conclusion which is in conflict with either the first or second principles stated above.

D. Is the Question an Attack on the Author?

If it be agreed that it is no criticism of a study made by a geographer to say that it is not geography, is it not a criticism of the geographer who made this study? This common attitude is based on the assumption that those who call themselves geographers should be working at geography. Regardless of the significance or value of a particular study, if it cannot be classified as geography, the geographer should not have made the study. Why not? The only requirement for work in any field of learning is competence, and if our colleague is said to be working outside the field of geography, geographers are not the ones to judge his competence in that outside field. Furthermore the final test of competence for any particular study is the work accomplished on that study. If the finished work is found to be original and sound, how can its author be judged incompetent to do it?

The fact is that the scope of the field of learning in which individual scholars are competent to work cannot be defined in terms of the specific discipline in which they were trained. Each of my readers, I have no doubt, could name certain topics outside the field of geography on which he would be more competent than he is on certain topics within the field.

[7] For example see Carl Sauer's discussions of specific works on geographic influences in history and of works in political geography in "Recent Developments in Cultural Geography," *Recent Developments in the Social Sciences* (1927), pp. 199 f., 207–211.

[8] Examples of this use of substantive works to test theoretical conclusions may be found in *The Nature of Geography*, pp. 122–125, 177 f., and 219. These include the two examples to which Klimm points an accusing finger. *Op. cit.*, 488.

It is not therefore a proper purpose in seeking to determine what is the nature and scope of geography to find limits that individual geographers may not overstep without criticism. The proper purpose is to provide orientation—to recognize a central core within and around which geographers work, radiating out in diverse directions, though ever conscious of where they are. If we observe that any of our colleagues, whether because of their personal inclinations or in pursuit of particular topics, are drawn so far from the central core that we think they have crossed into fields logically included in other disciplines, that conclusion carries no criticism. On the contrary, in the anticipation of gains that may result from cross-fertilization, we may well regard such expeditions with positive approval. We only ask that a worker on the periphery of our field shall not lose his sense of orientation so that he feels called upon to shout back to his colleagues: "Here is the proper center of our field; here is where all geographers should work."

Granting the value of recognizing complete freedom of the individual geographer to operate on due occasion as widely as the spirit moves him and his competence can safely carry him, is it not his business, the reader may ask, to devote most of his work to the field of geography? I presume that as a matter of intellectual and academic honesty, anyone who calls himself a geographer will wish to devote most of his attention to what he believes is geography. But since, as noted above, there can be no authority to determine what is geography, any statement by others that implied that they found his work to be outside geography would not constitute a criticism of his work, but only of his concept of geography. No one will question that any geographer's concept of geography, whether stated in methodological writings or expressed in his substantive works, is open to critical consideration by his colleagues.

We may summarize our discussion of the problems involved in putting the question "Is it geography?" by saying that the question is pertinent only for methodological purposes. Insofar as it arises from an individual's need to classify and organize in his thinking the particular piece of substantive knowledge included in a particular study, he is concerned only with his own answer to the question and therefore should have no reason to suppose anyone else is interested in his answer. For general discussion the question is in order only if the topic of discussion is a methodological one. In that case classification of substantive works may lead to critical reflections on methodological theories; in no case can they be considered as casting critical reflections on the substantive studies themselves or on their authors.

V. THE PERSONAL PROBLEM

The discussion of the geographer in the previous section brings us to what is perhaps the cardinal difficulty underlying all the problems discussed in this paper—the *personal* problem.

Throughout the sections preceding the last one, I have referred to writings by geographers as though they were things in themselves, existing independent of their authors. The justification for this assumption is that it is a fact. When a man

publishes something he has written, he has turned his child loose on the world to live or die, to influence readers, independent of anything he can do about it. Whether or not he continues to think well of it, even if he would totally denounce it, it continues its independent existence, coming to life whenever a reader in a library reacts intellectually to what *it* says—perhaps long after the original author is dead and possibly forgotten as a person.

If this were the whole of the picture we would have no problem. The problem exists because while articles once published, like the off-spring of the lower animals, are no longer attached to their authors, the authors are very like human parents in that they continue to be attached to what they have published. The attachment is not merely one of feelings; in major degree a man's brain-children determine his reputation in the field of learning.

The universal rule in learned critical discussions is that the critic considers not the writer but the writing. Though we know that criticism of the writing may hurt the person of the writer, we read critical reviews of substantive works without regarding legitimate criticism of the work as attack on the writer.

Methodological writings however seem much more closely associated with the person of the writer than are substantive works. The facts that constitute much of the content of substantive work obviously belong to no one; ideas appear as the cherished possession of him who expresses them. We accentuate this impression by a convention that appears unfortunate but unavoidable; though our concern is properly with writings rather than with writers, in methodological discussion particularly we refer to the writings not in terms of their titles, but in terms of the names of their authors. While substantive works are commonly distinct units whose titles are often convenient handles, sometimes better known than the names of the authors, the opposite is generally the case for methodological writings. If we refer to a work as "The Geography of the World's Agriculture," "The California Raisin Industry," or "Süddeutschland," the informed reader knows of what we speak. Even if it were feasible to refer repeatedly to such titles as "The Inductive Study of the Content of Geography," "Some Comments on Contemporary Geographic Methods," or "Die Wesen und die Methoden der Geographie," few readers would recognize that we were referring to studies familiar to them as the writings of Davis, Leighly, and Hettner. Further, in many cases, methodological studies are not distinct units; an essentially unified viewpoint may be presented in the course of several years in a number of articles each with an independent title. The only label that ties them together is the name of the author.

As a consequence of this tendency to think of methodological discussion in personal terms, a critic who subjects a methodological thesis to logical analysis is regarded as dissecting the writer who presented the thesis. If the original writer replies to explain or defend the thesis, he is regarded as defending himself and the discussion is considered as a personal conflict.

This is not because the theoretical issues involved are of such intense concern

to us; on the contrary since we are not sufficiently serious about them our attention is caught by the extraneous, but more exciting personal aspects. We have not yet attained the degree of objectivity that is presumed to underly a scientific discussion. An additional factor is the erroneous assumption that trained men of eminent standing in their field are expected to be free of any errors of logical reasoning. Consequently the discovery of any such error instead of being received as a stimulus to correct the thinking is taken as damaging criticism.

We do not view methodological discussion as an earnest and humble effort of fallible human minds to seek by interchange of ideas the closest approximation of truth. Rather the discussion comes to be considered as a *debate,* in which points of agreement are regarded as cancelled out rather than as underscored, points of difference magnified, the prize not truth but personal prestige.

If we could escape from this concern about persons, if in our discussions we could focus our interest on the writings rather than the writers, many of the difficulties previously noted would be eliminated. Whether a writer regarded his methodological papers as less important than his substantive works would then be recognized as irrelevant; relevant only is the question of how important the writings are in influencing the thought of readers. Whether a study had just appeared in print, was twenty years old, or even centuries old, would be seen to be equally irrelevant. Any work that influences the current thought of students may properly be discussed as of current interest. Whether it represents the present view of its author is not the concern of the critic of geographic writings. If the author no longer holds the views once expressed, but they continue to influence readers, it is his concern, not the critic's, to inform readers of the change in his thinking. The critic can properly be expected to take account of "current thought" in geography only as that is expressed in geographic literature.[9]

In sum, the universal rule in all branches of learning applies to discussions of methodology; scholarship is not concerned with persons but with writings. There is a continuing obligation to focus methodological criticism on writings rather than on persons, and to maintain the tone of the discussion on the impersonal level. If the present writer has at any time failed to adhere to these standards, he expresses his regrets to any who may have been offended. But it is only fair to remind the reader again that the obligation applies to both parties in reading a paper which thereby becomes a discussion between writer and reader.

Since much of our discussion of the mores in methodological discussion has been critical of the present customs and standards of American geographers as a social group, it is appropriate to close with a recognition of one established custom to which we may point with pride. I refer to what is, I hope, so well-established as a practice as to take on the nature of a compelling social law. This is, that even when a methodological discussion appears to produce conflicts between persons rather than between ideas, the engagements are regarded, at most, as those of a

[9] Cf. the discussion on this point in Klimm's review, *op. cit.*, 488.

tournament, not of a battle, and certainly not of a war. It should harm no one to be thrown from his intellectual horse—however high the horse—on the contrary, the experience may be taken as a part of a continuing education. Over a goodly number of years, American geographers have consistently adhered to the principle that methodological controversy is not a basis for personal enmity or schisms in the field. In the writing of *The Nature of Geography* therefore, great effort—greater than the reader is likely to realize—was made by the author and his editorial critics to avoid provocation that could lead to disruption within the geographic fellowship. This effort, whether completely successful in itself, has met with full cooperation, so far as I can learn, from all concerned. American geographers, whether they agree or disagree, maintain their standard of cordial intellectual relations.

DETERMINISM IN GEOGRAPHY

ROBERT S. PLATT
University of Chicago

DETERMINISM may persist as a false guide in geography even after environmentalism has been banished from the field.[1] Long ago extreme environmentalism was recognized as false, and now mild environmentalism also has been found misleading as an approach to geographic understanding.[2] But a complex kind of determinism may still be detected frequently in geographic work. In some cases a combination of environmental and cultural factors is taken to account for geographic phenomena in a cause and effect relation. Some of the factors are better defined than others, but all are supposed to be subject to investigation and evaluation leading eventually to complete explanation as scientific knowledge advances.

The primary question raised by this procedure is whether such an approach leads immediately to understanding or to misunderstanding in our present search for knowledge. A further question as to whether the basic idea of determinism ultimately may be found true or false is not involved and need not be included except as a matter of coincidental interest.

DETERMINISTIC APPROACH

Consider the geography of Argentina from an explanatory viewpoint as an example of this procedure. Argentina may be characterized as a virile South American nation having a productive territory of over a million square miles, a vigorous population of about 15,000,000 people, a rich landed gentry, a highly commercialized economy, a centralized dictatorial government, and a militant nationalism at odds with the United States.

In explanation of these phenomena the following major factors may be cited:

(1) A fundament of fertile mid-latitude plains bordering on the Atlantic, and territorial unity unbroken by physiographic barriers from the east coast to the Andes.

[1] Determinism, in the sense used here, refers to the idea that everything in human life is caused inevitably by previous events or conditions. Extreme environmentalism refers to the idea that everything in human life is caused by the natural environment; and mild environmentalism refers to the idea that human life should be viewed as under the direct influence of the natural environment.

[2] R. S. Platt, "Environmentalism versus Geography," *American Journal of Sociology*, LIII (March, 1948), 351–358.

(2) A racial heritage of white people from Europe, of colonial plus recent immigrant stock.

(3) A cultural heritage of Spanish land tenure and social organization.

(4) A reciprocal trade relation with Europe owing to the industrial revolution, particularly to the European demand for food in exchange for manufactured goods, and to steam transportation and refrigeration.

(5) A competitive relation with the United States, owing primarily to similar mid-latitude production.

(6) Military and political affiliations with Fascism in Spain, Italy, and Germany.

FAILURE TO EXPLAIN

These factors are in effect and of significance. As historical and geographical circumstances associated with Argentine development, they may help toward an understanding of the country. But will this list or any similar list, however amplified, or any such approach to the subject explain Argentina or reveal cause and effect relations?

The approach is misleading rather than revealing. The value of the specified factors is unmeasured and immeasurable; multitudes of other factors also are present, many of them different, some of them opposite in effect; countless incidents and decisions of critical value are largely unknown and unknowable; and alternative tendencies are ignored.

Some factors of the Argentine fundament provide a basis for unity, but there is no self-evident pre-existent unity, and some natural features provide bases for disunity. Even the natural barrier of the Andes is not an unequivocal factor as an international boundary. At one time the line between Argentine and Chilean jurisdiction was drawn in the dry plains far east of the Andes, and western provinces of modern Argentina were eastern communities of colonial Chile.

White racial stock provides a basis for vigorous development, but factors other than immigration from Europe seem largely responsible for recent advance; and there are other significant racial strains.

The factor of Spanish culture is expressed in a landed gentry. But other factors are expressed in agrarian movements which have modified and may obliterate the old system.

Trade connection with Europe is a prominent factor in Argentine economy. But American big business has played a leading rôle in Argentine development; and the trade of the United States with Argentina is greater than with most other Latin American countries.

European fascism is an obvious factor in Argentine government and politics. But French, British, and American democracy has been another factor. Democracy has developed more in Argentina than in most other countries of Latin America, and is as much alive as fascism, and more deeply rooted. The Perón dictatorship came into power and has remained by hairbreadth decisions against contrary forces

—through such incidents as the illness of a democratic president and Perón's fantastic release from prison.

So other factors appear, still without explaining Argentina fully. Minor incidents and critical decisions with their alternative possibilities pile up endlessly in the pursuit of causes.

UNKNOWABLE CAUSES

An illustration of a minor incident as a causal factor in great events is given in the old verse:

> For the want of a nail, the shoe was lost,
> For the want of a shoe, the horse was lost,
> For the want of a horse, the rider was lost,
> For the want of a rider, the battle was lost,
> For the want of a battle, the kingdom was lost—
> And all for the want of a horseshoe-nail.[3]

This illustrates the critical significance of an incident traced along one line of cause and effect. But what of all the other lines in the full circle of causal factors bearing on these events? What of the critical decision of the blacksmith who failed to secure the nail, and the antecedents of that decision, and all the other decisions in a complete explanation of a kingdom or of Argentina?

The preceding list of major factors for Argentina is not an explanation but a rationalization, an ex post facto set of causes picked to fit corresponding events, including items apparently consistent with results, and excluding everything else. Determinism is branded as a false guide because it prompts a futile pretense of explaining—futile and misleading at least in our present state of knowledge.

Conceivably we might hope sometime to explain the present and the past. These have been determined and cannot be changed, all the returns are in, all the choices between alternative possibilities have been made.

Full explanation is conceivable; practically this may remain impossible, considering not only the general factors of unmeasured value but also the unnumbered incidents and decisions of critical value, the horseshoe nails and the blacksmiths' decisions, which we have no means of tracing. Full explanation, in fact, involves the whole world and everything that has happened in it.

UNFORESEEABLE FUTURE

If we cannot fully explain the present and the past, even more surely we cannot fully predict the future—not only because of ignorance regarding the effect of all current incidents, but also because innumerable decisions are being made and will be made between alternative courses of action, leading to different possibilities.

For the past, all such decisions have been made and are therefore definitely determined, even though we cannot trace them all to their sources. But for the future these decisions are not yet made, and there is no indication that we shall ever

[3] "Benjamin Franklin, Poor Richard, 1758," B. E. Stevenson, *The Home Book of Quotations* (New York, 1934), p. 2041.

be able to make them in advance for our own future lives, to say nothing of our inability to make them in advance for the future lives of everyone else in the world.

In these decisions which form the chain of cause and effect in human affairs, the question of free will arises and is not proven pro or con. We may assume that there is no free will, that everything, past, present, and future, has been determined in a cause and effect relation beforehand, from the beginning of the world; and that we cannot really make choices between real alternative possibilities. But this does not seem to help us in our scientific search for knowledge. We seem to be just as far from full explanation of the present and past, in which all decisions already have been made, as from prediction of the future.

Since there is no proof against free will, it is unscientific to reject free will as if it were a closed question, and thus claim to know more about cause and effect than we can know.

But if for any reason we wish to make an unscientific practical choice between free will and pre-determinism, we had better make a consistent and harmless choice. In this case the consistent choice is to believe in free will, and to think and act in accordance with it, because free will is an assumption on which we all live every day—the assumption that we can choose what we do and that our choices are significant, not merely the gestures of puppets or new-born babes. This is also the only harmless choice in scientific thinking, because it leaves the consequences indeterminate to the same extent that a scientific refusal to choose between determinism and free will would leave them so.

The case against a deterministic approach in geography might rest at this point. There is sufficient evidence for leaving the approach indeterminate in our present search for knowledge, whether or not this is accompanied by belief in the ultimate truth of determinism.

INDIVIDUAL INDETERMINISM

However, the question of whether determinism is ultimately true or false has been mentioned as a matter of coincidental interest. This question has significance for geographers and may be pursued accordingly.

The following passages on the subject were written by William James:

> [Determinism] professes that those parts of the universe already laid down absolutely appoint and decree what the other parts shall be. . . . The whole is in each and every part, and welds it with the rest into an absolute unity, an iron block, in which there can be no equivocation or shadow of turning. . . .
>
> The stronghold of the deterministic sentiment is the antipathy to the idea of chance. . . . Many persons talk as if the minutest dose of disconnectedness of one part with another, the faintest tremor of ambiguity about the future . . . would ruin everything, and turn this goodly universe into a sort of insane sandheap or nulliverse, no universe at all. . . .
>
> [But] do not all the motives that assail us, all the futures that offer themselves to our choice, spring equally from the soil of the past; and would not either one of them, whether realized through chance or through necessity, the moment it is realized, seem to us to fit that past, and in the completest and most continuous manner to interdigitate with the phenomena already there? . . .

Decisions, for him who makes them, are altogether peculiar psychic facts. Self-luminous and self-justifying at the living moment at which they occur, they appeal to no outside moment to make them continuous with the rest of nature. Themselves it is rather who seem to make nature continuous; and in their strange and intense function of granting consent to one possibility and withholding it from another, to transform an equivocal and double future into an unalterable and simple past.[4]

WORLDWIDE INDETERMINISM

So much for individual free will; but this does not answer the question of determinism in the general trend of history and the broad forms of social structure and civilization, which might occur in pre-determined order, even though individuals were free to participate in one way or another.

On this question William James has said:

The mutations of societies . . . are in the main due . . . to the acts or the example of individuals whose genius was so adapted to the receptivities of the moment, or whose accidental position of authority was so critical that they became ferments, initiators of movement, or destroyers of other persons whose gifts, had they had free play, would have led society in another direction. . . .

Nations . . . may be committed by kings and ministers to peace or war . . . by prophets to this religion or that, by various geniuses to fame in art, science, or industry. A war is a true point of bifurcation of future possibilities. . . . Just so does a revolution or any great civic precedent, become a deflecting influence, whose operations widen with the course of time. . . .

The community *may* evolve in many ways. . . . The accidental presence of this or that ferment decides in which way it *shall* evolve. . . . The ways are to a large extent indeterminate in advance. . . .

It is folly, then, to speak of the 'laws of history' as of something inevitable, which science has only to discover and whose consequences any one can then foretell but do nothing to alter or avert. . . . The utmost the student of sociology can ever predict is that *if* a genius of a certain sort show the way, society will be sure to follow. . . . The evolutionary view of history, when it denies the vital importance of individual initiative, is, then, an utterly vague and unscientific conception, a lapse . . . into the most ancient oriental fatalism.[5]

More recently the process of social development on the earth has been described by a sociologist, Lynd, as follows:

It is people who do things. . . . The pattern is what it is because of . . . the dynamic individual, creators and carriers of culture, struggling fiercely to feel "at home" with themselves and others in their world. . . .

Human motivation however conditioned . . . by the past, always operates in the present: and at the white-hot edge of decision, the stuff of behavior which the historian finds so rigid when cold, is continually bent and directed into new forms. Choices, limited to be sure by past conditioning and by the momentum of movement along habitual grooves, but still choices to an important degree, are being made as man lives along. And these choices, including the factors determining their constriction and their potential range, are the central part of the business of social science. . . .

[4] William James, "The Dilemma of Determinism," *Essays on Faith and Morals* (N. Y., 1947), pp. 150, 153–155, 157, 158.

[5] William James, "Great Men and Their Environment," *Selected Papers on Philosophy* (N. Y., 1917), pp. 174–176, 188, 189.

We sail inevitably into the future, the sea is full of dangerous reefs and shoals, and drifting is more dangerous than choosing the course that our best intelligence dictates.[6]

The course of events in our world seems to be like a complex chain reaction into which new directive impulse, imperceptible in most cases, is injected by every human choice.

STATUS OF SOCIAL SCIENCE

Where does this leave us with respect to social science in general and geography in particular?—unable to explain anything fully, unable to know and measure cause and effect in any complete way, unable to establish absolute laws, unable to predict the future with any certainty.

This should leave us in a much stronger position scientifically and better able to justify our existence as scholars. The indeterminism of alternative possibilities makes the efforts of science worth while and important—efforts in the pursuit of knowledge, and in planning, public policy making, and education.

What is science anyway? Only a narrow and shallow definition makes it merely a search for cause and effect, or for quantification, or prediction, or universal laws. Science in the broadest sense, according to a geographer, Hartshorne, is "organized objective knowledge, . . . the pursuit of knowledge as reality by objective means."[7] Science according to a sociologist, Park, "is a systematic search for the facts about the world."[8] Science according to a philosopher, C. W. Morris, "is the record . . . of the more universal aspects of . . . a common world."[9]

According to a German geographer, Alfred Hettner, as quoted by Hartshorne, "the common idea that generalizations and laws themselves are the purpose of science is an extraordinary adherence to medieval scholastic realism. On the contrary they are merely the means to the ultimate purpose which is the knowledge of actual reality, the individual facts, either conditions or events."[10]

According to an anthropologist, Radcliffe-Brown,

the method of science in all instances is the analysis of a perceived analogy, an instance of perceived similarities and differences, which perceived and defined in the first instance rather vaguely, is in the end given a more precise definition. . . .

The modern theoretical scientist . . . excludes the concept of cause from his scientific investigation. . . . If . . . we were to define cause as the sum total of all necessary and sufficient conditions for a given event, then we could never exhaust the cause of anything. . . . When one is engaged in a system analysis, that which may be stated in superficially satisfactory causal terms can be more accurately stated in non-causal terms. . . . From the scientific point of view you are more accurate when you say there is a co-variation, and you can be still more accurate by defining that co-variation in quantitative terms.[11]

[6] R. S. Lynd, *Knowledge for What?* (Princeton, N. J., 1939), pp. 38, 49, 134, 186, 187.
[7] R. Hartshorne, *The Nature of Geography* (Lancaster, Pa., 1939), pp. 134, 196.
[8] R. E. Park, *Outline of the Principles of Sociology* (N. Y., 1939), p. iii.
[9] G. H. Mead, *Mind, Self, and Society* (Chicago, 1934), p. xxix.
[10] R. Hartshorne, *op. cit.*, p. 379.
[11] A. R. Radcliffe-Brown, "The Nature of a Theoretica' Natural Science of Society" (Transcribed notes, University of Chicago, 1937), pp. 35, 41, 42.

PROCEDURE IN GEOGRAPHY

Thus geography deals with perceived similarities and differences between areas, perceived in the first instance rather vaguely and in the end given a more precise definition, quantitative in some cases; tracing co-variation in space, and thus approaching "explanation in the only scientific way, that of observed coincidence."[12]

In any scholarly work there are clear-cut advantages in not claiming to do more than scholarship is able to do, not claiming to find cause and effect where this claim is misleading, not pretending to explain by rationalization. There are clear-cut advantages in admitting underlying assumptions, making explicit whatever is taken for granted, and then seeking accessible answers to appropriate questions.

In geography such questions as the following may well be included: What phenomena are observed? In what association of space and time? Under what conditions or circumstances? What patterns are discernible and what correlations? For the future what alternative possibilities appear within what known frame?

Our business is not to explain Argentina, but to discover and appreciate Argentina in the world pattern. We can even make conditional predictions or forecasts, which is all that any science can do. Taking for granted the history and geography of Argentina up to the present time, the immediate future appears narrowly limited. We can predict that if weather and economic conditions are good, a wheat crop will be harvested next season; and that if the provisions of the present (1947) constitution are carried out, Perón will not succeed himself at the next election.

We can make broader forecasts with correspondingly less certainty. Very probably Argentina will export shiploads of foodstuffs in the next five years, although quantities are uncertain. Very probably public opinion will be less effective in shaping public policy in Argentina than in the United States during the next decade, whether or not successful revolution be accomplished.

For the far distant future, the possibilities appear more and more divergent, though still within limiting circumstances—under conditions of air, land, and water, and of human beings in social relations. One possibility is that Argentina may become a powerful threat to the United States. Another possibility is that Argentina may be wiped out in atomic war. Another possibility is that Argentina may become a stanch friend of the United States in a peaceful world.

Whatever faith we have in learning or in living seems to brand determinism as a pseudo-scientific sanction of vulgar belief in the inevitability of war or depression or any prospective event. If we avoid a deterministic approach and give our best efforts to the pursuit and use of knowledge, we can rightly hope to bend our common course in the direction of our desire, and to cause a trend of events (cause in a true philisophic and not in a pseudo-scientific sense) toward greater human welfare.

[12] R. S. Platt, "Items in the Regional Geography of Panama," *Annals of the Association of American Geographers*, XXVIII, No. 1 (March 1938), 35.

THE DISTRIBUTION OF WATER POWER RESOURCES IN BRAZIL WITH REFERENCE TO THE PARTICIPATION RATIO CONCEPT*

HILGARD O'REILLY STERNBERG
Universidade do Brasil and Instituto Rio-Branco, Rio de Janeiro

THE geographic distribution of water power resources is expressed numerically and visually by a variety of devices. The first and most direct form of appraisal is the estimated water power capacity (in horsepower or kilowatts) for each geographic unit. Although bar graphs and other similar devices are utilized to represent this appraisal cartographically, areal diagrams, *i.e.*, figures of plane geometry having areas proportionate to the quantities involved, are most usual for this purpose. Thus, for example, circles of different sizes, with areas proportionate to the potential water power resources of the various countries, regions, or river basins, are commonly used on statistical maps.[1] Such circles may be subdivided into sectors proportionate to the ratio between actual output at a given date and the whole potential. The resulting pie-graphs are frequently used in map construction.[2] Polygonal figures may be employed in a similar fashion instead of circles either by (1) keeping the figure constant (*e.g.*, a square) and making areas variable, or by (2) grouping the correct number of equal-sized small figures (squares) so that the total areas of the resulting polygons are made proportionate to the available water-power capacity of the geographical units represented. A shaded or solid black area is often inset in order to show the proportion actually exploited.[3] Less direct re-

This contribution is sponsored for publication by Richard Joel Russell of Louisiana State University.

* The writer is indebted to Capt. Ary Barbosa Kahl, Engineer, Brazilian Army, for verifying all calculations involved in the present article. Professors Richard Joel Russell and T. Lynn Smith, of Louisiana State University, read the first draft of the paper. Their comments and suggestions were of help in the preparation of the final version, but they are in no sense responsible for its faults. Mr. Americo L. Barbosa de Oliveira, of the *Conselho Nacional de Águas e Energia*, and Mr. Luis Löfgren, Chief, *Seção de Energia Hidráulica, Divisão de Águas, Departamento Nacional da Produção Mineral* (Ministry of Agriculture), were good enough to check the statements in the finished manuscript. This was also read by Dr. William J. Griffin, Visiting Professor of American Literature at the *Universidade do Brasil*, to whom acknowledgments are due for criticisms and suggestions regarding use of the English language. Inking and lettering of illustrations were performed by the *Setor de Ilustrações, Seção de Estudos, Conselho Nacional de Geografia*.

[1] For an example, see R. H. Whitbeck and V. C. Finch, *Economic Geography* (4th ed.; New York: The McGraw-Hill Book Co. Inc., 1941), p. 219.

[2] See, for instance, Whitbeck and Finch, *op. cit.*, p. 220, or J. Paul Goode, *Goode's School Atlas; Physical, Political and Economic* (1943 ed.; New York: Rand McNally & Company, 1943), p. 40.

[3] See Walter Schmidt, *Geografía Económica*, translated from the German and annotated by Manuel Sánchez Sarto (2nd ed.; Barcelona-Buenos Aires: Editorial Labor, 1927), pp. 58 and 60.

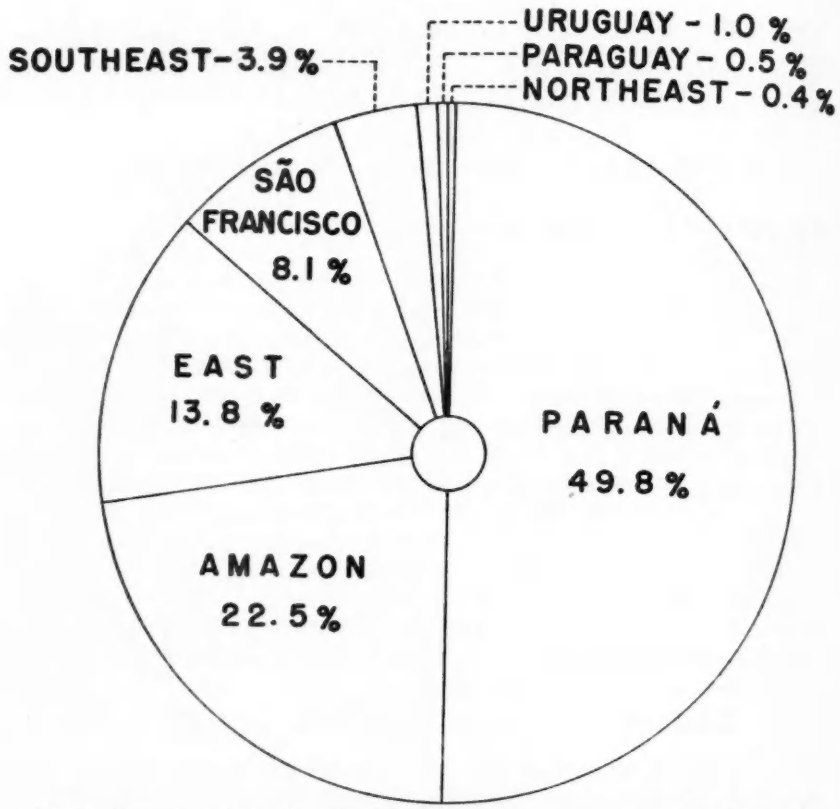

FIG. 1. Percentual distribution of estimated water power resources in Brazil, by hydrographic basins. Data from Instituto Brasileiro de Geografia e Estatística, Conselho Nacional de Estatística, *Anuário Estatístico do Brasil*, Ano VI—1941/1945. (Rio de Janeiro: Serviço Gráfico do Instituto Brasileiro de Geografia e Estatística, 1946.)

lations such as the density of hydraulic energy (power per sq. mi.) or the developed water power per 100 persons have also been cartographically represented.[4] In addition to this kind of statistical map, wide use is made of diagrams such as that representing the regional percentage distribution of potential water power, showing the parts of 100 which each region possesses.[5] Figure 1 offers an example of this sort of graph applied to Brazil.

[4] An example of the treatment of the first named relation will be found in Walter Schmidt, *op. cit.*, p. 52; of the second, in Ellsworth Huntington, *Principles of Economic Geography* (New York: John Wiley & Sons, Inc., 1940), p. 512.

[5] As in Charles Landon, *Industrial Geography* (New York: Prentice-Hall, Inc., 1946), p. 123.

Notwithstanding the large number of devices already in existence, fresh contributions are encouraged by the belief that "many presumably significant ratios still await discovery by geographers, or at least common use, either in tabular or in map form."[6]

THE PARTICIPATION RATIO CONCEPT

The present writer proposes to introduce an additional procedure for dealing with the geographic distribution of water power resources, an approach which he has tentatively named the *Participation Ratio*. This procedure may be used for analogous distributional studies.

The concept evolved from the consideration of the following table which shows, in absolute and percentile terms, the area and estimated water power resources of Brazil by hydrographic basins.[7]

TABLE I

AREA AND WATER POWER RESOURCES OF BRAZIL

Basins	Area		Estimated water power capacity	
	Sq. mi.	Percentage	HP	Percentage
Amazon	1,860,932	56.7	4,395,900	22.5
Northeast	342,309	10.4	88,400	0.4
São Francisco	224,230	6.8	1,573,300	8.1
East	234,558	7.1	2,693,500	13.8
Paraguay	136,023	4.1	89,500	0.5
Paraná	331,844	10.1	9,720,900	49.8
Uruguay	78.057	2.4	198.900	1.0
Southeast	78,218	2.4	758,700	3.9
Brazil	3,286,170	100.0	19,519,100	100.0

Source: Instituto Brasileiro de Geografia e Estatística, Conselho Nacional de Estatística, *Anuário Estatístico do Brasil, Ano VI–1941/1945.* (Rio de Janeiro: Serviço Gráfico do Instituto Brasileiro de Geografia e Estatística, 1946), p. 7.

[6] Wellington D. Jones, "Ratios and Isopleth Maps in Regional Investigation of Agricultural Land Occupance," *Annals of the Association of American Geographers,* XX, No. 4 (December 1930), 178.

[7] The circumscription of such hydrographic regions and the water power capacities attributed to each are in accordance with the *Divisão de Águas, Departamento Nacional de Produção Mineral,* of the Ministry of Agriculture. The official estimates of the hydroelectric potentialities refer to low water discharges and, in general, do not take into account the increment certain to become available through (1) the construction of dams and/or (2) the transposition of waters from one drainage basin to another. The expediency of the last named procedure has, in fact, already been conclusively established in Brazil by the quite spectacular example of the Cubatão power plant, near Santos, São Paulo. Here, man, anticipating what nature would undoubtedly consummate in time, has alienated or, as it were, "captured," a part of the Paraná Basin for the benefit of the Southeast Basin, draining directly into the Atlantic. This was accomplished by damming back the sluggish westward-flowing streams and conveying the reversed flow through a tunnel under the crest of the coastal escarpment and down the almost sheer drop to the power house, nearly 2,400 feet below. This, one of the largest plants in the world, has set the pattern

The comparison between the figures expressing percentage area and those representing percentage of power emphasizes the not-very-surprising fact that water power resources are most unequally distributed over the country's immense area. Thus, for example, the Northeast Basin, equivalent to 10.4% of Brazil's area, possesses only 0.4% of the nation's estimated water power capacity whereas the slightly less extensive Paraná Basin, equivalent to 10.1% of the total area, enjoys no less than 49.8% of the total estimated water power resources!

Conventional concepts and corresponding graphic presentation seemed somewhat inadequate for directing attention to such important facts concisely. A comparison of the water power capacities of any two given basins, regardless of whether the parallel is drawn between percentual or absolute estimates, possesses limited meaning unless the area of each hydrographic unit is simultaneously considered. Thus, in order to compare properly *two* basins, one must deal with *four* quantities; comparison should be made between two rates or proportions—*i.e.* the relation of water power capacity of the first basin to its area and the analogous relation obtaining in the second basin.

The chain of reasoning leading to the establishment of the index number here suggested is extremely simple. Initially, one evaluates the amount of horsepower which would correspond to the unit of area if distribution were perfectly homogeneous. Thus, for example, in the case of Brazil, dividing the total estimated water power capacity by the total area of the country (Table I), one obtains

$$19{,}519{,}100 \div 3{,}286{,}170 = 5.9$$

If water power resources were evenly spread, each square mile of Brazilian territory would be entitled to almost six horsepower. To determine the amount of horsepower that would be apportioned to each *município,* state, natural region, or hydrographic basin, the area of the chosen unit is multiplied by the above quotient. Under such an assumption, the Northeast Basin (Table I) would enjoy 2,033,316 HP:

$$342{,}309 \times 5.9 = 2{,}033{,}316.$$

It will be noticed that this ideal figure differs widely from the actual number of horsepower estimated for the basin. It is precisely this deviation which yields the

for other projects, such as, for example, the Macabú and Paraiba-Piraí-Ribeirão das Lages plants, now under construction in the State of Rio de Janeiro. Whereas these schemes take advantage of the great drop represented by the coastal escarpment, other projects, possible inland, may simply divert water from one valley to another, or even tunnel through the necks of incised loops carved by winding mountain streams (a method which has been suggested for the Rio das Antas, State of Rio Grande do Sul).

Finally, it is well to remember that a more complete knowledge of the interior may reveal as yet unsuspected power sites and/or prove some estimates to be excessive.

All this indicates that the water power estimates for each basin are liable to considerable modification and, therefore, may serve as yet another illustration of the fluidity, which, as Jean Brunhes so long ago indicated, characterizes statistical data in Economic Geography. See *Procès-Verbaux Sommaires, Congrès International de Géographie Économique et Commerciale tenu à Paris du 27 au 31 Août 1900* (Paris: Ministère du Commerce, de l'Industrie, des Postes et des Télégraphes, 1901), p. 44.

Participation Ratio. Its determination is the last step in the proposed method of analysis.

The final formula may be established as follows and applied to any given area,

$$\text{Participation Ratio} = \frac{\text{Actual estimated number of HP} \times 100}{\text{Ideal number of HP, distribution supposed homogeneous}}.$$

If the ideal and the actual numbers of HP of a given chorographic unit happened to be identical, the region would have a Participation Ratio of 100.

Applying the formula[8] to the hydrographic basins, as characterized in Table I, the following Participation Ratios were found:

Amazon	40	Paraguay	11
Northeast	4	Paraná	493
São Francisco	118	Uruguay	43
East	193	Southeast	163

The fact that, in comparing any two given basins by means of their Participation Ratios, one considers simultaneously their position with respect to the ideal base number (100) seems to be a useful character of the suggested procedure.

There is no overlap whatever between the ratio suggested here and mathematical expressions such as that proposed some years ago by Fred A. Carlson[9] in an attempt to express the relation obtaining between the present and maximum intensities of man's utilization of a given fraction of his environment. Divergence between the two indices is obviously reflected in the interpretation of their values. According to Carlson's conclusions, "areas of low geographical index numbers should disclose the future lands for human occupancy." No such specific statement can be made regarding interpretation of the Participation Ratio *per se*. The name was chosen purposely to indicate the broadness of the concept. To "participate" is to take a part in or to share in something. This something may be a useful portion of the natural landscape (water power—as in the example discussed in the present paper—iron ore, a forest product, etc.) whether utilized or unexploited; it may be a manufactured product; or, again, it may be some phenomenon having no economical significance whatsoever. The word "utilization" as defined by Carlson, however, "includes the thought of control, adaptation, and use of the environment." The example of a geographic unit having a large share of iron ore, but not exploiting it, serves to exemplify the divergence between the two index numbers: Participation Ratio would be high; degree of utilization, low. In addition to the basic, conceptual

[8] When percentages of area and of water power capacity are already available for each basin as in the present instance, lengthy calculations involving numbers with seven digits may be avoided and the process simplified by using the numbers expressing percentages, provided, of course, less precision is expected (the percentages are usually rounded off and rarely have more than one decimal). The formula is then written

$$\text{Participation Ratio} = \frac{\text{Percentage water power capacity} \times 100}{\text{Percentage area}}.$$

[9] "Geographical Index Numbers," *Science*, New Series, LXXII, No. 1864 (September 19, 1930), 300–301. See also *Annals of the Association of American Geographers*, XX, No. 1 (March 1930), 25–26.

divergence between the two indices, it might be noted that, whereas an attempt to measure the effectiveness of human occupancy is avowedly subject to conjecture, the Participation Ratio was devised simply as a means of manipulating statistical data, and its degree of accuracy is merely a direct reflection of the reliability of the statistical materials at hand.

As regards the graphic expression of the Participation Ratios, it seems to the writer that, for a convenient combination with the usual method of mapping estimated water power resources, viz. circles having areas proportionate to the number of HP, a procedure like that shown in figure 2 may be utilized.

HYDROGRAPHIC REGIONS

A succinct discussion of the basins delineated on figure 2 should help to show how the Participation Ratio is correlated with and reflects the physical characteristics of each hydrographic domain. In passing, and as a preliminary step, it is well to block out Brazil's general physiographic configuration by which drainage is conditioned. The country's relief is formed by two massifs—the Guiana and the Brazilian highlands—surrounded and connected by three geologically younger divisions—the Amazon Plain, the Paraguay Plain and the Coastal Plain. The two massifs (genetically equivalent and undoubtedly continuous below the Amazon geosyncline) consist of a massive basement or core of very ancient rock (mainly crystalline) partly overlaid with sedimentary and, to a lesser extent, with extrusive formations. The approximately sub-horizontal and relatively undisturbed nature of this layered structure is, to a large degree, responsible for the fact that the two massifs appear essentially as plateaus. The great majority of Brazilian rivers rise in these highlands which cover approximately 3/5 of the country's area. In many instances, the rivers are interrupted by falls where they drop over the plateau edges which are marked in places by quite dramatic escarpments. The highest elevations of the Brazilian massif are to be found close to the Atlantic seaboard and, particularly in the southern half of the country, both the ancient basement of the Brazilian highlands and the overlying strata slope gently away from the coast, the land surface roughly accompanying the general inland direction of the geological dip. These facts have a decided influence on the drainage.

Amazon Basin. Whether absolute or percentual estimates of water power capacity are considered, the Amazon Basin—which, in the official division this paper conforms to, includes the Tocantins-Araguaia Basin—can boast quite a large aggregate of such resources. Low Participation Ratio, however, should arrest any sanguine overestimate, for it translates adverse topographic conditions which, offsetting propitious climatic factors, do not favor an advantageous concentration of valuable power sites. Thus, whereas an enormous mass of atmospheric water drenches the central or axial portion of the Amazon drainage basin (mean yearly rainfall nowhere less than 65 inches in the Hylaea lowlands), rain drops reach the earth's surface nearly at tidewater level, divested, as it were, of the potential energy they previously contained.

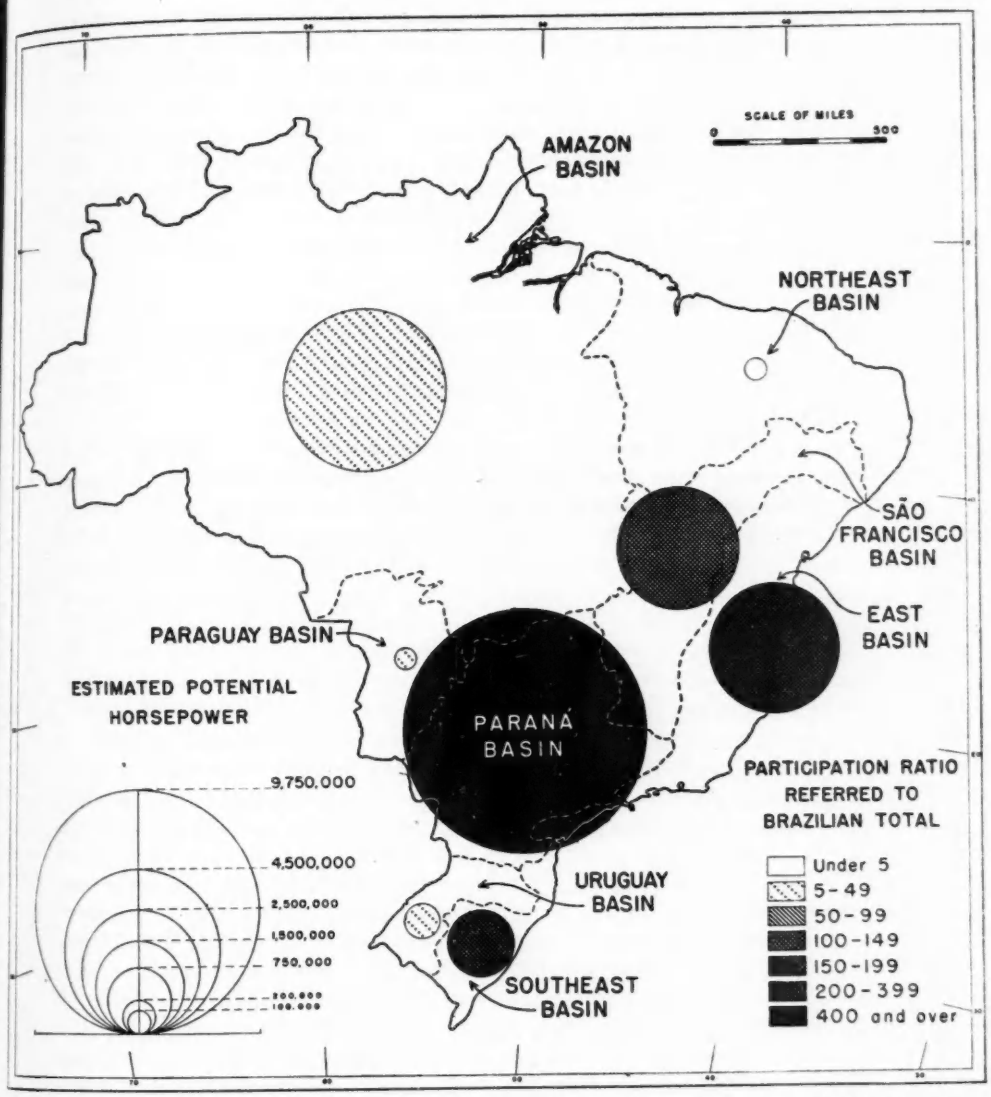

FIG. 2. Potential water power capacity and *Participation Ratio* of hydrographic basins in Brazil. Data from Instituto Brasileiro de Geografia e Estatística, Conselho Nacional de Estatística, *Anuário Estatístico do Brasil*, Ano VI—1941/1945. (Rio de Janeiro: Servico Gráfico do Instituto Brasileiro de Geografia e Estatística, 1946.) Map reduced from bi-polar oblique conic conformal projection, according to Conselho Nacional de Geografia, *Mapa do Brasil* 1: 5,750,000 (1945), upon which the basin boundaries were superimposed.

A large part of the Amazon basin which lies in Brazilian territory is, in effect, a flat, low country. The states of Amazonas and Pará and the federal territory of Amapá, roughly totaling 1,160,000 square miles, through which the Amazon River flows, may well be compared, let us say, to Louisiana: of the 26 *município* seats in Amazonas, only two are situated at elevations above 300 feet; of the fifty-three county seats in Pará and Amapá, only two are above 300 and only five are above 150 feet. The longitudinal profile of the Amazon River is extremely flat. The riparian village of Tabatinga, situated on the Peruvian border where the Amazon river enters Brazilian territory, has an altitude of less than 250 feet though it lies more than 1,700 miles from tidewater. A rough estimate will show that the river descends less than 0.15 feet per mile—a slope considerably gentler than that of the Mississippi River from Cairo, Illinois, to Head of Passes. As further evidence, one might add that at Óbidos, more than 700 miles from the ocean, the river bed lies below sea level; it has been claimed that the stream's discharge in front of this town is affected by the ebb and flow of the tide.

The sum of water power resources attributed to the Amazon Basin is not derived, therefore, from the main river, but is spread out over a number of tributary streams where these descend over rapids and cascades from the Guiana and Brazilian Massifs to the Amazon Plain. It is worth noting that the two roughly parallel "fall-lines" do not coincide with the zone of greatest concentration of inhabitants, a narrow strip along the main stream. This fact defers the utilization of these power sites.

Northeast Basin. The expression Northeast Basin is applied by the *Divisão de Águas* to a group of distinct basins extending eastward from the State of Maranhão to that of Alagoas and discharging directly into the Ocean. Variations in climatic, geognostic, and vegetational factors divide this basin into two parts: the eastern one is characterized by violent fluctuations in stream flow; the western constitutes a transition to the Amazon Basin. The Parnaiba Basin may be considered as being roughly the boundary between the two subdivisions of the Northeastern drainage area.

The fact that such a large portion of the streams in this Basin are intermittent is responsible for its extremely low Participation Ratio (which shows it to possess one twenty-fifth of the water power resources it would be entitled to if distribution were homogeneous). Since potential horsepower is determined in Brazil by the flow at low water, power resources of these water courses are naturally considered nil. The mode of discharge of these streams finds apt expression in the local population's statement that they are subject to *cortar* (literally, *cut*). The interruption of flow first sections the river into a rosary of stagnant pools and then, as the drought persists, transforms the bed into the "wide, tortuous roads paved with fragmented quartz and extremely hard sandstone [and quartzite]" described by the classic Euclydes da Cunha.[10]

[10] *Canudos; Diário de uma Expedição* (Rio de Janeiro: Livraria José Olympio Editora, 1939), p. 164. First published in *O Estado de São Paulo* in 1897.

The main factors responsible for this intermittency are threefold. Climatically, the region is characterized, at all seasons, by high temperature and low relative humidity. Rainfall is erratic and frequently takes place in violent, but short-lived downpours during the so-called "winter" season. Geologically, a large part of the region may be characterized as a stripped or exhumed peneplain: except for residual patches of the sedimentary covering, the practically impervious crystalline basement complex outcrops over most of the area; as a result, runoff is swift. The sparse vegetational cover consisting, in its most typical parts, of cacti and sundry other xerophytes—an association known as the *caatinga*—is inadequate to lower the runoff appreciably.

São Francisco Basin. The São Francisco Basin, in contrast to the two hydrographic units thus far reviewed, has a Participation Ratio above 100. This signifies that it possesses more than its ideal share of the country's water power resources. The São Francisco River possesses two distinct zones of sizable power possibilities; one is upstream from Pirapora and the other, downstream from Cachoeira de Sobradinho where the river begins to spill over the edge of the Brazilian massif. The claim has been put forward that the most salient characteristic of the São Francisco River is its mean altitude.[11] Between the two localities mentioned, it flows for more than 800 miles with the very moderate average slope of 0.39 feet per mile. Downstream of Sobradinho, the longitudinal profile becomes steeper. The increase in slope culminates in the Itaparica and the Paulo Afonso falls where the river descends 70 feet in less than half a mile and 260 feet in about a mile and a quarter, respectively.

As it flows northward, the São Francisco enters the semi-arid region of Brazil and might well exemplify that type of stream for which the name "exotic" has been reserved. The volume of flow suffers considerable reduction in this area, where tributaries are mostly intermittent. These are not even computed in the Basin's official estimated power capacity whereas some of the perennial affluents upstream, such as the Rio das Velhas and the Paraopeba, are important sources of existing and prospective power.

East Basin. The East Basin corresponds, in a large measure, to the extremely youthful drainage of the eastward-facing coastal escarpment of the Brazilian Massif. Headward erosion has enlarged the drainage areas of some of the constituent basins so that they now head inland on the plateau; other less developed streams have not yet managed to push their sources beyond the crest of the escarpment by capturing appreciable portions of the Paraná or São Francisco drainage basins. The extreme youth of the escarpment—in past at least, a fault line scarp—is reflected in the steep and irregular slopes of the streams. The existence of centers of population with names containing the word Cachoeiro or Cachoeira (*i.e.* waterfall) is most significant.

[11] Luís Flores de Morais Rego, *O Vale do São Francisco; Ensaio de Monográfia Geográfica* (São Paulo: Editora Renascença S. A. 1945), p. 24.

Climate combines with topography to produce a very high Participation Ratio. Moisture-ladened, maritime masses of air, encountering the escarpment (especially in its southern portion), are forced to rise and thus produce abundant orographic rainfall on the seaward-facing slopes of the massif.[12] The Participation Ratio would be even higher if the official division did not include, in the northern part of this basin, streams having characteristics of flow similar to those of the Northeast Basin; the Itapicurú River, for example, although perennial in its lower course, "cuts" its upper course.[13] The fact that, regardless of this handicap, the East Basin has a high Participation Ratio, enjoying practically double the amount of HP proportional to its area, is an indication of the excellence of the power sites it offers in its more southern latitudes.

The primitive vegetal cover of this area, a luxuriant rainforest, has been in part destroyed or thinned out.[14] Large residual forest reserves are, nevertheless, still to be found in this hydrographic unit—such is the case of the Rio Doce Valley—and help to smooth out the stream discharges, thus contributing to the high Participation Ratio.

Paraguay Basin. The most remarkable feature of the Paraguay Basin is certainly the huge interior lowland, known as the *Pantanal* (a misnomer; for the area is not a swamp) and claimed to be the the largest floodplain in the continent.[15] This interior depression (Corumbá lies at 426 feet above sea level) is enclosed and dominated on the east by an amphitheater-like escarpment—the western border of the Brazilian Massif. Where the streams leave the highlands, their profiles are, of course, broken by falls and rapids, the only appreciable power sites this basin has to offer.

The extreme variation in annual precipitation of central Brazil (Cuiabá, for example, has an average of 8.9 inches of rainfall in February and 0.4 inches in July)[16] is responsible for the accentuated fluctuation in stream flow. This bestows

[12] This familiar effect of the Brazilian Massif on the intensity of precipitation has recently been presented in a very clear fashion through the combination of topographic and pluviometric (as well as phytogeographic) profiles at right angles to the coast of São Paulo. The profiles were constructed in the manner used by Daniel W. Mead for California and already applied to the State of São Paulo by Catullo Branco, "Producção Hydro-Electrica Factores Economicos," *Boletim da Inspectoria de Serviços Públicos*, No. 1 (Dezembro 1936), 12. José Setzer, "Contribuição para o Estudo do Clima do Estado de São Paulo," revised and reprinted from *Boletim do Departamento de Estradas de Rodagem* (*"D.E.R."*), IX–XI (1943–1945).

[13] A recent example of the erratic discharge prevalent in this portion of the Basin may be reported. In October 1947, Salvador, Capital of the State of Baía, experienced acute power shortage resulting from the extremely low discharge of the Paraguaçú River; in December of the same year, the floodwaters of this stream invaded major riverine localities.

[14] Here flourished the tinctorial brazilwood (*Caesalpinia echinata*, Lam.) from which the newly discovered land derived its name; extracted since 1503, it became another victim of destructive exploitation.

[15] Roughly 250 miles by 150 miles, according to Pedro de Moura, "Bacia do Alto Paraguai," *Revista Brasileira de Geografia*, V, No. 1 (Janeiro-Março 1943), 7.

[16] *Normais Climatológicas* (Rio de Janeiro: Ministério da Agricultura, Serviço de Informação Agrícola, 1941), p. 73.

upon the Pantanal landscape what might be called a dual personality; the extensive grassy plains of spring, pastures as rich as they are vast, give place to an immense sheet of water in autumn. Needless to say, the small winter discharge of the rivers descending the escarpment decreases the estimated power capacity and is, to a great extent, responsible for the low Participation Ratio.

Belieing its name—Mato Grosso—the state in which the Brazilian portion of this basin is located is not entirely covered with a thick (*grosso*) forest (*mato*) mantle, but, on the contrary, displays a predominantly herbaceous or scrubby vegetation. This fact, in a lesser degree, through its negative influence on the run-off, also makes for a low Participation Ratio.

Paraná Basin. The water power resources of the Paraná Basin, which occupies only approximately one-tenth of the country's area, are equivalent to the sum total estimated for all other basins combined. As its Participation Ratio consequently shows, this basin has the benefit of nearly five times the amount of power which would be its due if distribution were uniform.

To what is this exceptionally high Participation Ratio due? Geological and geomorphic facts are predominantly responsible. Not far from the course of the Paraná River lies the axis of the Paraná syncline, with major tributary streams flowing as consequents on its flanks. In the lower portion of its course across the Brazilian Massif, the Paraná River has recently become entrenched in the resistant, effusive lava sheets which extend over a large area of southern Brazil (including the syncline), and descends gradually to the level of the Plate lowland. Above the so-called Sete Quedas (Seven Falls—there are, as a matter of fact, a greater number) or Guaíra at the upstream end of a 25 mile-long gorge entrenched in the hard rock, the river flows on the plateau alternately moving sluggishly in wide sheets and tumbling over basalt ledges such as that which produces the Urubupungá Falls. Here also, on the highland, it receives the contribution of most of its important tributaries, in this way concentrating an enormous mass of water at the site of the Guaíra Falls. The only noteworthy exception discharging below Sete Quedas is the Iguaçú River which has itself begun entrenching the basalt. As a result, the famous Iguaçú Falls (a scenic drop of more than 260 feet) have been eroded back a short distance (less than 15 miles) from the river's confluence with the Paraná. Not only has the Paraná River itself been rejuvenated recently—a fact which is evident from the great number of small hanging valleys below the Sete Quedas—but the whole region has apparently been tilted westward, depressing the area west of the synclinal axis and uplifting the area east of it (this movement also brought about rejuvenation of the streams draining the coastal escarpment). As a result of this crustal movement and of the resistant basalt cover, the left bank tributaries show youthful profiles and are themselves important sources of water power. Excellent power sites, such as the Maribondo Falls, on the Rio Grande and the Salto do Avanhandava on the Tieté River have already been developed (the latter in 1946) and construction of power plants at similar sites is being studied

at the present moment. Although it has been suggested that such sites correspond to small local anticlinal structures,[17] this opinion is not undisputed.[18]

Uruguay Basin. Although the Brazilian portion of the Uruguay River is occasionally constricted in its upper reaches to narrow gorges the most outstanding of which are at the Mucunã Falls and the Estreito de Marcelino Ramos, it is outside of Brazilian territory that this river, subject to great fluctuations in discharge, seems to concentrate most of its water power possibilities. This is particularly true where it finally leaves the plateau in the vicinity of a town, significantly named Salto,[19] in the Republic of Uruguay.

It is worthwhile noticing that, whereas the Amazon Basin possesses 22.5% of the country's total water power resources and the Brazilian share of the Uruguay Basin only 1%, their Participation Ratio is about the same.

Southeast Basin. The Southeast Basin is simply a continuation of the East Basin and shares the general characteristics already outlined. The Participation Ratio is, accordingly, of the same order.

CONCLUSIONS

1. Using the geographical distribution of water power resources in Brazil as a vehicle, a new procedure is submitted for deriving an index number from two or more quantities when it is necessary to take into consideration simultaneously the extent of the particular areal units in which these quantities exist.

2. It is proposed that this index number be called the *Participation Ratio.*

3. Figure 2 suggests one way in which this number may be graphically presented. Sectors proportional to the actually developed power (*i.e.* present degree of utilization) may be superimposed on the existing circles.

[17] Chester W. Washburne, *Petroleum Geology of the State of São Paulo, Brazil* (São Paulo: Commissão Geographica e Geologica do Estado de São Paulo, Boletim No. 22, 1930).

[18] Luís Flores de Morais Rego, *Notas sobre a Geomorphologia de S. Paulo e sua Genesis* (São Paulo: Instituto Astronomico e Geographico de São Paulo, 1932), p. 12.

[19] This declivitous stretch, situated between a smooth gradient on the gently sloping highlands and the practically horizontal lower course, accounts for the fact that the Uruguay River has been considered "the most desirable source of hydroelectrical power for the city of Buenos Aires." See Juan F. Büchi, *Las Fuerzas Hidráulicas de la República Argentina* (Barcelona—Buenos Aires: José Montesó, 1945), p. 16. Faulting played an important part in the origin of this discontinuity, according to one outstanding Argentine geologist. See Joaquin Frenguelli, "El Río Uruguay entre 'Salto Grande' y 'Paso Hervidero'; Apuntes Geologicos y Morfologicos," Anales de la Sociedad Científica Argentina, E.VI.T.CXXVIII, XII (1939), 342–368. A tripartite agreement between Brazil, Argentina, and Uruguay is now being considered for the construction of a dam at the site in question.

CLARK WISSLER, 1870–1947

GEORGE F. CARTER

THE death of Dr. Clark Wissler in New York City on August 25, 1947, was a loss not only to American anthropology but also to American geography. Wissler had long given special attention to two problems of importance to human geography. These were the nature of the relation of man and culture to physical environment, and the related question of the discovery and delimiting of cultural areas or, in geographical parlance, regions.

Wissler's major works attracted considerable geographic attention. An article describing the importance to geographers of his concepts and definitions of regions, together with full-page reproductions of his maps of *Food Areas of the New World* and *Culture Areas of the American Indian,* was printed in *The Geographical Review,* Volume 10, 1920. Herein the importance of Wissler's work for human geography was so well stated that it is quoted below in excerpts.

> A culture area is defined rather by its center whose geographical position is coincident with the habits of the most typical tribes than by the periphery. . . . Wissler stresses environment as the static factor. It does not produce the culture but furnishes the medium in and by means of which the culture flourishes and tends to hold it there when once rooted. The tribes occupying any of our culture areas make use of a certain number of the possibilities presented by that area and specialize in these, and they are perpetuated as social habits that resist change.

Wissler continued this line of thought in "The Psychological Aspects of the Culture-Environment Relation," *American Anthropologist,* N.S., XIV, No. 2 (1912) by arguing from psychological grounds for the relatively small influence of the physical environment on culture. His view of the nature of culture and the relation of culture to physical environment, and his clear differentiation between physical and social environment is here clearly and simply stated. It could still well serve as a model for human geographers.

In "Aboriginal Maize as a Typical Culture-Complex," *American Journal of Sociology,* XXI, No. 5 (1916), Wissler again stated his case, this time declaring that although geographical environment contributed to the stabilization of cultures, it must be noted that the environment is not a formative factor but *only* a perpetuator.

Wissler was head of the American Museum's Department of Anthropology for thirty-seven years. During this time he actively promoted work in anthropology throughout the Americas. His own work was most intimately concerned with the Indians of the Plains. He published eleven monographs on the Siouan and Blackfoot tribes of that area and encouraged work which led to the production by others of forty-five mostly monographic works on the Indian peoples in and about the

Plains area. A further product of this work was his consideration of the influence of the introduction of the horse into the Plains. In "The Influence of the Horse in the Development of Plains Culture," *American Anthropologist,* N.S., XVI, No. 1 (1914), he showed that although the horse was of importance, it did *not* revolutionize the way of life in that area. He also showed that there was an assemblage of traits related to the use of the horse that, deriving from the Spanish, travelled with the horse throughout the Plains.

Some of Wissler's general works attracted wide attention. In 1912, he published *North American Indians of the Plains.* His widely known *The American Indian* appeared in 1917. This systematic treatment of Indian life in America brought together in organized form a previously unsynthesized mass of material. Two general books, *Man and Culture,* in 1923, and *The Relation of Nature to Man,* in 1926, attracted further attention for their discussion of the content of culture and the relation of culture to environment. In 1940, he published his last major work, *The Indians of the United States.*

This brief notice cannot discuss all of the 222 titles in his bibliography. His was a productive life, and his works will continue to repay study not only by the anthropologist but by the general student of man and particularly by the student of human geography.

REVIEWS AND ABSTRACTS OF STUDIES

COMMENTS ON SOME PUBLICATIONS OF THE CHINA INSTITUTE OF GEOGRAPHY[1]

Literature on Chinese geography in the past has been inadequate in quantity at least, if not in quality, for a thorough understanding of the geographical characteristics and problems of that country. The addition of any competent publications are more than welcome, especially if they are based in whole or part on field observations. Unfortunately, the language barrier remains a major one and will continue to hamper academic communication until American geographers become bilingual or until some international language of science, an academician's Esperanto, serves to join Chinese and American geographers linguistically. This statement is made with all due respect for the multi-lingual background of many of our Chinese colleagues who are capable of expressing their findings not only in Chinese, but frequently also in English, German, and French.

The language barrier operates formidably in the case of the publications of the China Institute of Geography, formerly of Pei-pei, Ssu-ch'uan, and now at Nan-ch'ing (Nanking). The Institute was founded in 1939 by the Sino-British Board of Trustees for the Administration of the Boxer Indemnity Fund Remitted by the British Government.[2] It has operated throughout the war years since then and has published certain of its findings in the quarterly journal *Geography* (Ti-li),[3] which has been published since 1941 despite the handicaps of materiel scarcities and the pressing needs of China for applied rather than academic research. The journal is one of two major geographical journals published in China, the other being the *Journal of the Geographical Society of China,* published by the National Central University in Nan-ch'ing. While the *Journal* includes English abstracts of its major articles, *Geography* is published only in Chinese, but a table of contents in English is published on the back cover. Articles have been examined in issues through June, 1945,[4] and have been found to be highly instructive and ably presented. Microgeographical field studies, historical geography, climatology, and urban geography are all represented. Understandable enough the greater number of articles are concerned with unoccupied West China. Despite the handicaps of poor paper, the maps, diagrams, and sketches are presented in ways easily comparable, so far as methods and intent are concerned, with the better maps published in this country.

The Institute maintains a meterological station on the Fukien coast; its exact location is not given, but the data were used in the publication of at least one issue of *Oceanographic Papers* (Hai-yang Shu-k'an) in 1942. The four articles in the issue deal mainly with geological, paleontological, and oceanographic topics of potentially great interest to the physical geographer and oceanographer. No table of contents in English is included. The type of information is similar to that found in the publications of the Ch'ing-tao Observatory in Shantung province.

In addition to the two publications referred to above, the Institute has published a series

[1] These publications were forwarded from China through the courtesy of Floyd E. Masten for the Association repository.

[2] C. Y. Chang, "Geographical Research in China," *Annals of the Association of American Geographers,* XXXIV, No. 1 (March 1944), 62.

[3] Shannon McCune, "Geographical Journals in Asia," *The Professional Geographer,* December, 1947, 36.

[4] Thanks are due Mr. Arthur M. Hummel whose assistance was invaluable for the rapid translation of difficult passages in Chinese where the author's meagre knowledge failed.

of monographs entitled *Geographical Memoirs of the China Institute of Geography* (Chung-kuo Ti-li Yen-chiu-so Ti-li Chuangk'an). These monographs are for the most part the result of field studies carried on by the members of the Institute staff during the latter years of the war. All display a high calibre of workmanship and should prove of the greatest value to the specialist on China. They concern areas in interior China about which geographical field data have been very meagre. The *Memoirs* are in Chinese except for a title page in English on the back cover. Photographs are not included, probably because of the paper shortage, but numerous sketches are substituted with adequate, though not always satisfactory, effect.

Number 1 of the *Memoirs* is reviewed below and is a thorough regional study of the drainage basin of the Chia-ling Chiang in Ssu-ch'an. Number 2 was not available in its entirety to this reviewer; only Volume 2 of Part I, dealing with climate of the Han-chung Basin, was at hand. An English title page does not appear on this issue. Number 3, also reviewed below, is another regional study of the Han-chung Basin in Shensi province which was compiled from the same data as appeared in Number 2. Number 4, like Number 2, is not complete; only the first volume, dealing with the geomorphology and climate of the Ta-pa Shan, has been received. It should be noted that all four monographs were issued in 1946, from January in the case of the first to December for the fourth. It is hoped that more of these monographs will appear shortly.

Other materials have been published by the Institute. Of these the most significant is the Atlas of Ssu-ch'uan which also is reviewed below. Others have been reported, but have not come to the attention of this reviewer.

The Geographical Expedition of the Chia-Ling Chiang Valley. Part I, 2 volumes. Volume I (Text) 75 pp.; Volume II (Sketches and maps) 62 Plates. Part II, 135 pp. with sketches, maps, bibliography, table of contents. *Geographical Memoirs of China Institute of Geography, No. 1,* Pei-pei, Ssu-Ch'uan, China, January, 1946. (In Chinese) $10 \times 7\frac{1}{4}$ inches.

This work is the result of a field survey by the China Institute of Geography during the war years in the valley of the Chia-ling Chiang, one of the "Four Rivers" of Ssu-ch'uan, which enters the Chang (Yang-tse) Chiang at Ch'ung-ch'ing. (Ch'ung-king).

Part I deals with the geomorphology of the drainage basin and is divided into a text volume and an accompanying volume of maps and sketches. The text divides the basin into three areas: the Tsou Ling area at the western headwaters of the river, the Ta-pa Shan area at the eastern headwaters, and the so-called Basin area which includes the greater part of the valley proper. Each of these areas is subdivided into smaller units for more detailed description. The last portion of the text deals with the river systems of Ssu-ch'uan and discusses the special problems of stream flow as related to geological and physiolographical factors.

The volume of maps and sketches includes a number of topographic maps at 1:10,000 of portions of the valley, a variety of geological sketch maps and maps of stream flow, and a great number of pen and ink sketches which are used in place of photographs. The value of these sketches is considerable, but the lack of photographs is felt at many points. There are also a series of maps showing progressive changes in the course of the river. The Chia-ling Chiang is a mature stream incised rather deeply in its upper course, but broadening out downstream. At no place, however, does the valley floor appear to be over a mile and a half in width; it is characterized at points by occasional cut-offs and almost everywhere by sand bars and bare islands.

Part II is a single volume devoted to the regional geography of the valley. The volume is arranged in five parts: agriculture, mining, transportation, population, and settlements. The last section is subdivided into agricultual settlements, industrial and mining settlements, commercial settlements, administrative centers, and housing. Much of the information presented in Part I is summarized also in Part II in map form. This volume is of greater interest to geographers than the first since it treats the valley as a region in terms of its patterns of human occupance and their functional interrelations and not in terms of less useful physiographic divisions. Illustrations and maps are numerous (no photographs) and apparently well executed although the patterns used on this isopleth maps are poorly chosen in many cases and difficult to read. Both dot and isopleth maps are used and there are a number of sketch maps of the river itself showing channels. There are also tables of the volumes of river traffic in 1940 and 1941.

The section on settlements classifies settlements according to function and size. An

interesting set of maps shows the development of market towns and the fluid character of the market function as it moves from one village or town to another. Maps at 1:10,000 are supplied for all the larger towns and a number of smaller villages. These are land-use maps commonly using a classification the major divisions of which are administrative or public, industrial, commercial, and residential. The volume concludes with sketches of house types found within the region.

Number 4 of the Memoirs entitled "The Geographical Expedition of the Ta-pa Shan" has been published at least in part; only Volume I, on "Geomorphology and Climate," has been received. It describes the geology, drainage, and topography of the Ta-pa Shan, those eastward extensions of the K'un-lun Shan. The second section of the volume discusses weather and climate of the area and there are numerous maps, diagrams, and sketches which fill out the work.

The reviewer does not pretend to have done more than skim through the texts of these reports, but the maps were examined with care and they were found to be both interesting and informative. The specialist on China will find that the data here presented will help fill in the rather hazy knowledge of interior China. Future publications of this kind should be welcomed and disseminated widely. It is impossible to conceive of generalizing scientifically about the implications of China's geography from a solid empirical foundation until that foundation is erected by means of numerous representative field studies of this kind.

T. C. Wong, E. F. Chen, Y. Y. Hsue, and P. T. Liu, *The Geographical Expedition of the Han-Chung Basin, Shensi.* Volume I (Report) 200 pp.; Volume II (Sketches and Maps) 92 Plates. Index. *Geographical Memoirs of the China Institute of Geography, No. 3,* Pei-pei, Ssu-ch'uan, China, November, 1946. (In Chinese) 10×7¼ inches.

The Han-chung Basin lies to the southwest of Si-an and is drained by the Han Chiang. It is included by Cressey within his Central Mountain Belt Region which separates North from South China. The study was initiated in October of 1940, and was finished in the fall of 1941; publication was delayed by the war.

The text is divided into three chapters, the first dealing with the natural background, the second with the human and cultural background, and the third with the regional geography of the Basin. The first chapter includes geology and geomorphology, climate, soils, and vegetation; the second describes population, settlements, agriculture, transportation, and commerce; and the third proposes regional division into the Basin Proper, the Transitional Hill Region, and the surrounding Mountain Region. These are further subdivided for clearer description and discussion.

The second volume, the maps and sketches, follows the same style of presentation found in Number 1 of the *Memoirs.* Materials parallel the text closely in order and organization. There are geological and topographical maps, climatic maps and graphs, and soil and vegetation maps on a variety of scales. Crop production maps and maps of arable land are included as are also large-scale land use maps of the larger towns. Graphs, maps, and circle diagrams are used to illustrate the flow of commodities to and from the Basin.

In addition to this *Memoir (No. 3),* a portion of *No. 2* has come to hand. In *Memior No. 2,* Part 1 deals with the natural background of the area discussed above. Volume 2 of Part 1, the only one reviewed, deals with the climatology of the Han-chung Basin. Raw precipitation and temperature data for a number of places in and around the Basin are included. The climatology of the Basin is discussed in terms of the regional climatic classifications of Köppen, de Martonne, Thornthwaite, and Wissman. A brief bibliography is included.

L. S. Chou, H. T. Hou, and S. C. Ch'en, *Economic Atlas of Szechuan (Ssu-ch'uan).* Volume I, 72 pp. (Atlas); Volume II, 131 pp. (Explanatory text), index bibliography. Pei-pei, Ssu-ch'uan: China Institute of Geography, April, 1946. Volume I, 10½×15 inches; Volume II, 7½×10 inches. (In Chinese).

According to the introduction to the atlas this is the first in a series of provincial atlases to be issued by the China Institute of Geography. Ssu-ch'uan was chosen because it was relatively untouched by the war and because there was a great deal of material available on that province. The atlas and text are based on three kinds of sources: reports of government agencies, books and publications, and field studies made by members of the Institute. The introduction further mentions the inadequacies of certain of the statistical data and freely admits that interpolations have been made where necessary between conflicting sources of information.

Stimulus for the atlas came from the British "Maps for the National Plan" which were used in part as models. Furthermore, specialists were consulted in order to check particular findings and results; G. B. Cressey is the only non-Chinese mentioned. Field studies apparently were begun shortly after the outbreak of the Sino-Japanese War and the occupation of North China by Japan. That work continued during the war is a monument to Chinese persistence in the face of great odds. Although the atlas was designed originally for both foreign and Chinese readers, the text is wholly in Chinese and the atlas itself is in Chinese with English titles on the plates.

The atlas contains 72 plates and one transparent overlay on which is printed the drainage system and the principle cities and towns. All plates except two are maps of the province and are on the same scale, 1 : 3,000,000. Among the plates are a terrain diagram; a topographic cross-section of the province; and maps of physiographic regions, climatic regions, soils and geology, population density, iron and coal reserves, crops, industries, and transportation. Plates 71 and 72 show the major towns of the province at 1 : 50,000.

The second volume, a supplement to the atlas, contains 71 sections or paragraphs which explain each of the map plates. In addition there is a long series of tables which list statistics of agricultural and industrial production by minor civil divisions. Information is quite recent, but in only a few instances are the periods of observation more than three or four years in length; most frequently the data are for one year only.

These two volumes will add considerably to the understanding of China's geographical problems, and completion of further provincial atlases should serve to fill in great blanks in the economic geography of non-coastal China. Though printed on paper of poor quality, the volumes are, with some exceptions, commendably clear and the maps show imagination, not always well directed, in the use of map symbols. The great difficulty in using such a work as this lies in the fact that the reliability of basic data is not made explicit from place to place. Thus, it may be assumed that a dot map of rice cultivation will be more accurate for the areas immediately adjacent to the larger cities such as Ch'ung-ch'ing and Ch'eng-tu than for the peripheral areas such as the Ta-pa Shan in the north. The uncertainty which attaches to this kind of qualification could have been removed only by specific statements concerning the reliability of local data.

NORTON S. GINSBURG
University of Chicago

A NOTE ON THE ANGLO-EGYPTIAN SUDAN

R. A. Hodgkin, *Sudan Geography*. Education Department of the Sudan Government, McCorquodale & Co. (Sudan) Ltd., 1946.

The recent protest of the Egyptian government to the Security Council of the United Nations against a continuation of the condominion status of the Anglo-Egyptian Sudan has placed this relatively little-known country among the problem areas of the world. While the Washington and the New York newspapers carried full-page, paid advertisements setting forth the Egyptian position in popular terms, more serious articles on the economic and political aspects of the situation were also being published. For example, the British viewpoint was well summarized in a recent article by Sir Harold MacMichael, "The Problem of the Anglo-Egyptian Sudan," *United Empire*, XXXVIII (1947), 121–126. The Egyptian point of view was ably presented by Mohamed Awad, "Egypt, Great Britian and the Sudan, an Egyptian View," *The Middle East Journal*, I (1947), 281–291. The longer and more detailed study by K. D. D. Henderson, *Survey of the Anglo-Egyptian Sudan 1898–1944* (London: Longmans Green & Co., 1946) discusses the various problems of the country, from farming (irrigation and crop diversity) to education (popular opposition to the education of women and retarding of technical education due to "the usual snobbery of the black-coated worker toward the craftsman"). In these and other publications, however, scant attention has been paid to the diversity of natural and cultural factors of geography which make the Sudan so varied and the phrase "unity of the Sudan" merely a political catch-word. It is here that Mr. Hodgkin's book does admirable service. Originally intended for use in the Sudan secondary school, it also throws light on a country where

geographical information outside of that incidental to the engineering and geological studies of Nile irrigation projects is limited.

The diversity of the Anglo-Egyptian Sudan is great even when its size, 970,000 square miles, is considered. To the north is a vast stretch of land where lack of water always constitutes the major problem. Sparsely occupied by Arabian nomads, this is the desert fringe of the Mohammedan world. In the extreme south is another area where water is also a problem, not because of the lack of it, but because of its superabundance. Here in the swamp area of the Sudd and in the adjacent uplands live Negro migratory herders and farmers who constitute a fringe of Black Africa. Between these two regions are two others. To the west of the Nile on the uplands of Kordofan and Darfur, the natives cultivate durra and collect gum arabic from hoshab trees. East of the Nile lies the flat, clay-soiled Gezira, where what has been termed "one of the most interesting social, political and economic experiments outside the Soviet Union" is taking place (*The Sudan, The Road Ahead*, London: Fabian Publications, Ltd., Research Series No. 99, 1945). Here commercial cotton growing on irrigated land is a cooperative venture of the tenants, the government, and the Sudan Plantations Syndicate.

Mr. Hodgkin's book presents this diversity in greater detail than the broad picture sketched above. Beginning with the combined cities of Khartoum and Omdurman, the administrative center of the country, the author takes up such units as the Kababish nomads of the northwest, herders of camels, goats, and sheep; the grassland of Butana with its combined cattle raising and harig (fire) cultivation; the Red Sea Hills and the rail route to the old port of Suakin and the modern Port Sudan; and a year with the Dinka in the Sudd who spend half their time as nomadic cattle herders and half as cultivators. The organization of the book could have been improved. As it stands, the Sudan is divided partly on the basis of natural regions and partly on the basis of the dominant tribal life. Boundaries are usually not indicated by the author and can scarcely be approximated by the reader. The glossary for non-Sudanese readers is extremely helpful. The front and back end papers bear maps, one of place names and the other of tribes. The numerous small maps and pen sketches scattered through the text add much to the book. Mr. Hodgkin's work is a useful contribution to our knowledge of an area of which we know little and need to learn more.

H. THOMPSON STRAW
Falls Church, Va.

REGIONAL VARIETY IN NORWAY

Tore Sund and Axel Sømme, *Norway in Maps*. Bergen: A. S. John Griegs Boktrykkeri, 1947.

The broad features of the geography of Norway are all too frequently passed over by rapid reference to fjords, mountains, and dependence upon the sea. This present contribution certainly offers much to teachers and students alike in the realization that Norway has wide regional diversity not only physically, but in terms of occupance as well. *Norway in Maps* consists of three parts: a 96-page, paper covered volume of text; a 52-page, paper covered volume of sketch maps and photographs; and a collection of selected topographic maps, 19 in number, together with a key of Norwegian topographic sheets. The text volume includes a brief discussion of the state of topographic mapping in Norway; an analysis of each of the maps in the collection; a table showing date of survey, publication, and revision for each map; a page of map symbols; and an extremely useful table of English equivalents for Norwegian geographical terms. The volume of sketch maps and photographs has pictures to accompany all of the selected areas and sketch maps, largely geological, for some of them. On the covers of both booklets, cartograms of Norway show the general location of each of the selected areas. The maps themselves are folded and included in a cardboard case.

The choice of maps is excellent. The first five, for example, indicate characteristic landscapes in the more populous southeastern part of the country. With these should be included the sixth which illustrates the highland of southern Norway where the rivers of the southeast have their sources. Norwegians recognize three distinctive zones in the southeast: a lowland zone where forests have largely been removed and where land use is relatively in-

tensive; a middle forested zone where settlement is closely tied to the river valleys and where the use of the timber resources overshadows all other economies; and a highland zone where much of the land lies above timber line and is usable only for summer pasturage. Of the first six maps, three illustrate the lowland zone; two, the forested zone; and one, the highland zone. In addition, four of the sample areas lie along the course of one river, the Glommen. The first of these four shows the Frederickstad-Sarpsborg industrial concentration, the most important in all Norway, along the banks of the lower course of the stream where it cuts across an area over which farms are thickly scattered. The second shows a portion of the agricultural lowland somewhat further inland. These two contrast vividly with the two examples of the middle zone where the few farms are concentrated in the river valley and where forest covers much of the total area. On the highland sheet almost the only evidence of human activity is the presence of *seters,* upland farm buildings used only in summer when animals are pastured in this area.

The collection includes a single example of the southern Norwegian coast along the Skagerrak, five examples from western Norway, and seven examples from the area northward from Trondheim. Especially well treated among the western Norway examples are the Jaeren area, "a piece of Denmark hung on to Norway," and the Bergen area. The Vestvågøy portion of the Lofoten is similarly well handled.

Mention must be made of two weaknesses. First, there is no sketch map showing a regional division of Norway. Such a map would make it possible for the reader to know the extent of any landscape type and to form a more satisfactory opinion of the completeness of coverage. Second, the text volume has numerous language difficulties. Assuming that this work is not a translation, for there is no indication that it is, the authors' manner of expression leaves many questions in the English reader's mind. Likewise there are several typographical errors. Despite these weaknesses, *Norway in Maps* is a distinct contribution to the source material available in English on the geography of Scandinavia.

HENRY MADISON KENDALL
Amherst College